Intention to adopt pro-environmental behaviors among university students of hard and soft sciences: the case of drinking by reusable bottles

Intention to adopt pro-environmental behaviors among university students of hard and soft sciences: the case of drinking by reusable bottles

Running head: PRO-ENVIRONMENTAL BEHAVIORS AMONG STUDENTS OF HARD AND SOFT SCIENCES

Angela Fedi*, Francesco La Barbera**, Annabelle De Jong*, Chiara Rollero*

*University of Turin, Department of Psychology, Italy

** University of Naples Federico II, Department of Political Sciences, Italy

Corresponding author: Francesco La Barbera, Dipartimento di Scienze Politiche, Università degli Studi di Napoli Federico II, via Rodinò 22, 80138 Napoli (NA), Italy. E-mail: francesco.labarbera@unina.it

Submitted on 08/29/2020; revision submitted on 12/29/2020

Abstract

Purpose. The market of bottled water is one of the largest in the world. Paradoxically, the consumption of water in plastic bottles is highest in countries rich in potable tap water of excellent quality. With this study we wanted to gain a better understanding of the factors that foster or hinder the intention to use refillable water bottles by university students and to determine whether their study program played a moderating role.

Methodology. Within the framework of Ajzen's theory of planned behavior (TPB), we conducted this cross-sectional study to understand the influence of attitudes, norms, and perceived behavioral control on the intention to drink tap water from reusable bottles. Italian university students (n=540) majoring in the hard (42.4%) or the soft (57.6%) sciences completed an anonymous self-report questionnaire.

Findings. For both groups there was a significant association between attitudes and intention to use a refillable water bottle. The intention to drink tap water was also influenced by perceived behavioral control among the hard science students, whereas among the soft science students the descriptive norm exerted a significant influence.

Originality/value. This is the first application of TPB, a well-established theoretical and methodological framework, to understand the intention by university students to drink tap water from reusable bottles. Within the framework of TPB this study is the first to address this specific pro-environmental behavior and explore the potential moderating role of university studies programs, which proved significant.

KEYWORDS: pro-environmental behavior; theory of planned behavior; sustainable consumption, attitude; perceived behavioral control; structural equation modeling.

1. Introduction

By virtue of its properties of strength, durability, lightness, and ease of use, plastic has been a major driver of advances in modern life and is now ubiquitous. In the interest of safeguarding environmental and public health, our dependence on plastic needs to be reduced (European Commission, 2018). One of the most common forms of packaging are plastic bottles. While there is evidence that the use of recycled PET or organic plastics for the production plastic containers can reduce their ecological footprint, and greenhouse gas emissions in particular (Benavides, Dunn, Han, Biddy, & Markham, 2018), when potable water is available and of good quality the use of refillable containers is the best way to minimize resource waste and pollution.

Bottled water is one of the world's fastest growing consumer products (Etale, Jobin, & Siergrist, 2018). Its production and trade have countless negative implications for the environment and human health (Legambiente & Altraeconomia, 2018). Owing to its unique characteristics, bottled water enjoys exponential growth: it is a perfect example of the consumer paradigm (Royte, 2008; Shiva, 2002). Although water is freely available in nature, packaged water now ranks as the most widely sold beverage in the world (Etale et al., 2018). But its production and consumption present a paradox: it takes on average 3 liters of water to produce 1 liter of bottled water (Pacific Institute, 2007). According to data from the Beverage Marketing Corporation (BMC, 2018), the countries that consume bottled water the most are those that need it the least, namely, the industrialized countries with an abundant supply of potable water.

Italy ranks second to Mexico in per capita consumption of bottled water. Italy has an abundant drinking water supply monitored for quality and purity; there are citizen initiatives that advocate access to water as a common good (Mazzoni & Cicognani, 2013) and a referendum addressing this issue was held in 2011 (www.acquabenecomune.org; Dell'Isola, Di Antonio, Ficco, Forni, & Russi, 2012). Yet according to a recent national survey (Censis Foundation, 2018) 90.3% of Italians drink bottled water. Consumer preference for packaged water derives from mistrust in the companies that manage and supply domestic water, perceived differences in the taste of mineral

water brands, and beliefs about the health benefits of bottled water promoted in advertising claims (Censis Foundation, 2018; Dell'Isola et al., 2012; Legambiente & Altraeconomia, 2018). Top consumers are the Millennials (18-34-year-olds).

2. Theoretical framework

While there is inconsistent evidence about why people prefer drinking bottled water to tap water (Labra & Casiraghi, 2010), individual psychological variables (e.g., subjective beliefs about taste and safety) most likely play a central role. The consumption of bottled water is shaped by a host of factors: quality and health concerns, organoleptic characteristics, price and convenience, lifestyle, and environmental concerns (e.g., Doria, 2006, 2010; Gleick, 2010; Kang, Grable, Hustvedt, & Ahn, 2017; O'Donnell & Rice, 2012; Van der Linden, 2015).

Two interconnected studies were carried out at the University of Constance, Germany (Debbeler, Gamp, Blumenschein, Keim, & Renner, 2018). In the one, about 600 students completed a questionnaire investigating their perception and consumption of bottled water and tap water. The sample was divided into bottled-water consumers (73.5%) and tap-water consumers (26.5%). Analyses revealed a polarized attitude towards the two types of water. There was a difference in taste preference and beliefs about water quality and health: a higher perception of risk about tap water and a stronger belief in the goodness of bottled water by the bottled-water consumers. In the second study, a group of students was divided according to their preference for tap or bottled water. In a blind tasting experiment, the participants were presented samples of four different types of drinking water: two samples of bottled water (one sparkling and one natural) and two from the university water supply (one of which artificially carbonated). The students had to identify the type of water and arrange the samples in order of preference. Not only were they unable to distinguish tap water from bottled water in most cases but also indicated a preference for tap water in 64% of cases. Taken together, the study findings highlight the illusory beliefs underlying the preference for bottled water (Debbeler et al., 2018).

Quantitative and qualitative studies conducted in academic settings around the world (e.g., Espinosa-García et al., 2015; Levêque & Burns, 2018; Saylor, Prokopy, & Amberg, 2011; Van der Linden, 2015; Ward et al., 2009) have investigated similar variables and returned similar results: skepticism about the quality of tap water, beliefs in the greater purity, safety, and goodness of bottled water, and perception of differences in taste are the main factors behind the consumption of bottled water.

In their study in a public university in the Netherlands, Van der Linden (2015) observed that a promotional message discouraging the purchase of bottled water was made more salient by previous activation of both injunctive and descriptive social norms. Injunctive norms are determined by individual perceptions of what significant people approve or disapprove, thus guiding behavioral choice on the basis of reward and social punishment that individuals expect. Differently, descriptive norms are based on observation of the behavior of others in a given context: after seeing others more likely to and more frequently engage in a certain type of behavior, an individual will believe that the behavior is the most appropriate and effective in those circumstances (Cialdini, Reno, & Kallgren, 1990; Fishbein & Ajzen, 2010).

Another often investigated aspect in water consumption preferences is the degree of access to the product. Among the reasons Italians give for preferring bottled water, about a quarter say "because it is convenient, always available" (Censis Foundation, 2018, p. 9). Similarly, interviews conducted as part of a study in Germany and Switzerland report that even people who drink tap water at home often buy bottled water when away from home because they can buy it almost anywhere (Etale et al., 2018). A study at Purdue University (Indiana, USA) found that the ease with which bottled water can be found seems to be a barrier to reducing its consumption by students (Saylor et al., 2011). A qualitative study at the University of Birmingham (UK) showed that the greater availability of bottled water was a stronger determinant in its purchase than beliefs about health benefits (Ward et al., 2009). The perceived availability and ease of access to bottled water

overshadow information about the quality of tap water (Espinosa-Garcìa et al., 2015) and the real availability of filtered tap water (Saylor et al., 2011).

In this regard, Ajzen (1988) observed that the likelihood of having an intention to act is modulated by the perception of control, a variable determined by evaluation of external obstacles combined with individual expectations of succeeding in overcoming them. In a study involving university students in the northeast United States, an increased perception of control over the possibility not to buy bottled water had a negative influence on the intention to purchase it (Xu & Lin, 2018). All considered, the alternative between consuming bottled or tap water seems to underline the role of rational, perceptive, and social aspects, in which beliefs, social approval, and perceived control constitute the elements of a reasoned choice.

In the framework of a reasoned action approach (Fishbein & Ajzen, 2010), the theory of planned behavior (TPB, Ajzen, 1985, 1991) posits that a specific behavior (e.g., drinking bottled water or tap water) is preceded by the intention to adopt that specific behavior. Intention, in turn, is influenced by three factors. The first is the attitude toward the behavior (ATT), which is determined by beliefs about the likely consequences of the behavior (behavioral beliefs). For instance, the more favorable the perceived consequences of drinking tap water, the more positive the attitude will be. The second factor is the perceived social pressure in relation to the behavior in question, which is the subjective norm (SN) in the TPB. A subjective norm is determined by the beliefs that important others would approve or disapprove a certain behavior (injunctive norm) or that these social referents themselves are likely to adopt that behavior (descriptive norm). The third factor is perceived behavioral control (PBC), which depends on an individual's beliefs about being capable of adopting a behavior, also in relation to perceived factors that may facilitate or impede that behavior.

TPB has been successfully used to predict and explain behavior in a variety of domains (see Fishbein and Ajzen, 2010, for a review), also in relation to sets of pro-environmental behaviors (de Leeuw, Valois, Ajzen, & Schmidt, 2015) or specific topics such as sustainable mobility (Bamberg,

Ajzen & Schimdt, 2003; Wang, Fan, Zhao, Yang, & Fu, 2016), "green" purchasing choices (Dean, Raats, & Shepherd, 2012; Sparks & Shepherd, 1992), and domestic use of environment-friendly products (Pierrette, Heitz, Barbier, & Daniel, 2018), recycling and reducing waste (Carrus, Passafaro, & Bonnes, 2008; Chu & Chiu, 2003; Terry, Hogg, & White, 1999), water and energy saving methods (Cooper, 2017; Ru, Wang, & Yan, 2018; Srivastava & Mahendar, 2018). Importantly, TPB-based surveys have shown their robustness as regards the influence of social desirability and questionnaire format (Armitage & Conner, 1999).

For the present study, we applied the theoretical framework and methodology of TPB to explore the intention of a sample of Italian university students to drink water from a reusable bottle. Refillable bottles are a convenient alternative to plastic bottles, and many universities are installing water bottle refilling stations (Uehara & Ynacay-Nye, 2018). Studies investigating the potential or obstacles to consuming tap water among university students have explored factors behind the choice of using reusable bottles (e.g., consumer perception of risk and benefits) (Qian, 2018); however, there is scarce knowledge about the factors that contribute most to the intention to use bottled water in different contexts (Dìez Antigüedad, Agirre, & Rico, 2018).

In addition, we also wanted to determine whether the type of university studies program moderates the relative power of the antecedents to intention. The effects of the TPB constructs on intention and/or behavior can be influenced by moderator variables. Recent studies have investigated such moderation in the framework of TPB, and this avenue of research holds promise for TPB-based research (La Barbera & Ajzen, 2020). The moderators investigated to date include gender (Robledo, Arán, Sanchez, & Molina, 2015), age (La Barbera & Ajzen, 2020), personality factors (de Bruijn, Brug, & Van Lenthe, 2009), ethnicity (Blanchard et al., 2007), attitudinal ambivalence (Conner, Povey, Sparks, James, & Shepherd, 2003), ethnocentrism, and self-construal level (Vabø & Hansen, 2016).

Quite surprisingly, despite extensive research involving university students, the moderating effect of the type of program has been little studied to date. Differences in the study *curriculum*

might influence the relationship between the TPB constructs. In their study, Maresh and colleagues (2016) found differences in the effect of subjective norm on intention across groups of university students (majors in technology and engineering vs. business studies).

For the present current study, we wanted to compare the differences between students majoring in a STEM (science, technology, engineering, mathematics) program versus those majoring in humanities and social science. In his seminal paper, Biglan (1973) organized disciplines along three dimensions derived by a multigroup scaling: 1) hard vs. soft sciences; 2) abstract vs. applied; and 3) interested or not with life/animated subjects. For example, STEM are located at the *hard* end of the hard–soft continuum and are characterized by a larger consensus on contents and methods compared to the humanities and social sciences at the *soft* end of the continuum. Hard and soft sciences have been linked to differences in culture and cognitive style: the humanities and social sciences rely on evaluation and interpretation of world phenomena, whereas the hard sciences deal largely with control and mastery of such phenomena (Becher, 1994).

Accordingly, we expected to find differences between students majoring in the hard or the soft sciences in relation to the effect of attitude (i.e., evaluation of behavior) and perceived behavioral control (i.e., feeling of having control over behavior) on their intention to drink tap water from a refillable bottle.

3. Materials and Methods

3.1 Participants and procedure

The study was conducted at the university of [blinded for peer review], in northwest Italy. This is one of the oldest and largest universities in the country and one of the first, in Italy, to have a Green Office, a hub which “leads, coordinates and promotes every activities and initiatives about environmental sustainability within the University of [blinded for peer review]” (http://www. website blinded for peer review). The sample was composed of 540 students (426 women; age range 18-35 years, *M* 23.21, *SD* 2.90) recruited online through posts on the university’s social

networks (Facebook and WhatsApp); they received no compensation for participation. More than half (n=311) were enrolled in soft science studies (history, philosophy, arts, educational sciences, linguistic and cultural studies, political and social sciences); the remaining (n=226) were enrolled in hard science courses (medicine, nursing, biology, chemistry, agriculture, physics, mathematics, information technology).

Data were collected by means of an online self-report questionnaire which took about 20 minutes to complete. The study was presented as an opinion survey; participants were informed that there were no right or wrong answers. The target behavior was clearly identified with the following statements: "The following items are about using a refillable container for carrying water when at university (hereafter, reusable bottle) rather than buy a plastic bottle. Think, for example, of a metal or hard plastic bottle, or a glass bottle. Instead, plastic bottles are EXCLUDED, even if filled several times."

The study complied with international ethical guidelines for psychological research (see https://www.apa.org/monitor/jan03/principles). Anonymity of data and participant privacy were protected during the study. Informed consent complying with Italian privacy laws was obtained before administration of the questionnaire.

The suggested sample size for applying structural equation models (SEMs) is about 200 participants, multiplied by the number of groups in multigroup SEMs (see http://davidakenny.net). For our study, we wanted to compare two groups of students (majors in soft vs. hard sciences). Hence, we reckoned that a sample ≥500 participants would be adequate in size.

3.2 Measures

Drawing on the tenets of TPB, the questionnaire included multi-item measures of intention, attitude, injunctive subjective norm, descriptive subjective norm, and perceived behavioral control. As described above, carrying a reusable bottle for drinking water while at university was the target behavior of these measures. The items were built following the guidelines devised by Fishbein and

Ajzen (2010) for the direct measure of the TPB constructs. The measures are described below; Table 1 presents the full list of items and basic statistics.

Table 1.

Descriptive statistics of the items employed

Item	***M***	***SD***
In the next weeks, when I attend university, I will carry a refillable bottle for drinking water	5,92	1,62
In the next weeks, I will try my best to use a refillable bottle for drinking water at university	5,83	1,74
In the next weeks, I intend to use a refillable bottle for drinking water at university	5,93	1,70
When I am at university, using a refillable water bottle for me is not useful/useful	6,48	1,10
When I am at university, using a refillable water bottle for me is dangerous/safe	6,21	1,13
When I am at university, using a refillable water bottle for me is unpleasant/pleasant	5,98	1,31
According to the people I care about, it is important that I use a refillable water bottle when I am at university	5,27	1,42
Most people I admire would approve me using a refillable water bottle at university	6,11	1,35
Most people attending my university use reusable water bottles when at university	3,23	1,62
Most people I know at university use refillable water bottles to drink	3,49	1,82
When I am at university, using a reusable water bottle depends on me	6,21	1,18
When I am at university, I can use refillable water bottles to drink	5,71	2,02
When I am at university, using a refillable water bottle to drink is difficult/easy	5,80	1,50

Note. The table shows means (M) and standard deviations (SD) of the items included in the study questionnaire.

1. Intention. Three items (Cronbach's α=.92) investigated the intention to use a reusable water bottle (e.g., 'In the next weeks, when I attend university, I will carry a refillable bottle for

drinking water'). Participants marked their answer on a 7-point Likert-type scale from 1 (very unlikely) to 7 (very likely).

2. Attitude. The same item (i.e., 'When I am at university, using a refillable water bottle for me is…') was replicated three times (Cronbach's α=.74) to measure the attitude towards reusable water bottles. Participants marked their answers on a 7-point Likert-type scale from 1 to 7 (e.g., unpleasant-pleasant).

3. Perceived behavioral control. Three items (Cronbach's α=.56) assessed the perception of control over the use of a reusable water bottle (e.g., 'When I am at university, using a reusable water bottle depends on me'). Participants indicated their agreement with the statements on a 7-point Likert-type scale from 1 (absolutely false) to 7 (absolutely true).

4. Subjective norms. Two items (Spearman-Brown rho = .69) investigated the injunctive dimension of subjective norms (e.g., 'According to the people I care about, it is important that I use a refillable water bottle when I am at university') and two items (Spearman-Brown rho = .83) measured the descriptive dimension of such norms (e.g., 'Most people attending my university use reusable water bottles when at university'). Participants marked their answers on a 7-point Likert-type scale from 1 (absolutely false) to 7 (absolutely true).

At the end of the questionnaire, participants were asked to indicate their age, gender and degree course.

4. Results

4.1 Descriptive statistics

Table 2 presents the means and standard deviation (SD) of the variables and their correlations. As expected, intention correlated with measures of attitude, subjective norm, and perceived behavioral control, which were intercorrelated among each other. No statistically significant between-group differences in mean scores were found (ts < 1.24, ps = ns).

Table 2.

Correlations, means and standard deviations of study variables' aggregate scores

Variable	1	2	3	4	5
1. Intention	5.89 (1.57)				
2. ATT	.579***	6.22 (0.96)			
3. SNi	.351***	.398***	5.69 (1.21)		
4. SNd	.219***	.129**	.116**	3.36 [a] (1.59)	
5. PBC	.428***	.397***	.257***	.193***	5.91 (1.14)

Note. The table shows Pearson's *r* correlation coefficients. Diagonal cells report the variable mean (standard deviation in parentheses). ATT = Attitude; SNi = Subjective norm – injunctive; SNd = Subjective norm – descriptive; PBC = Perceived behavioral control.

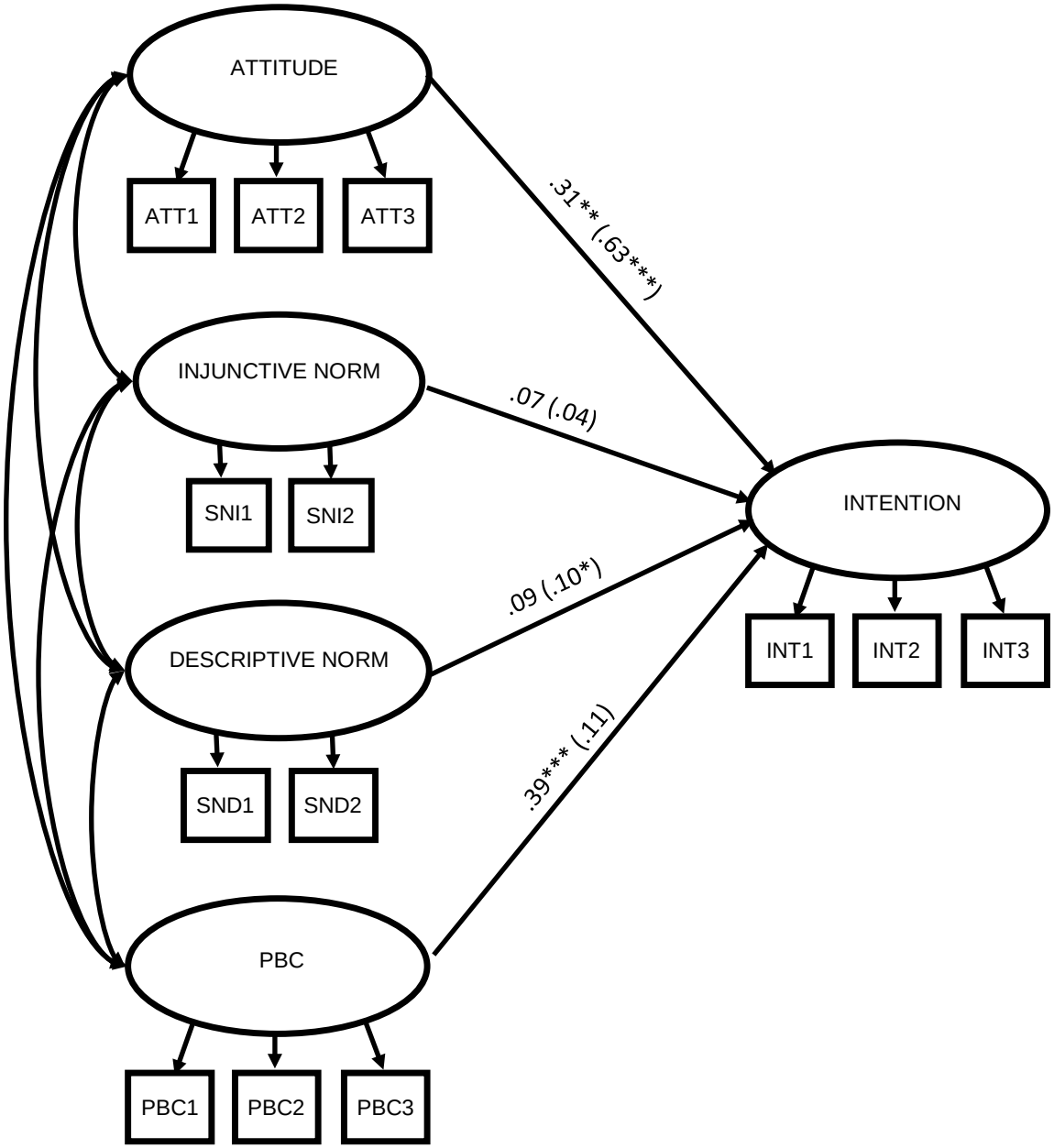
* = p < .05; ** = p < .01; *** = p < .001

4.2 Structural Equation Modelling (SEM)

SEM was carried out using STATA 15. Model fit was assessed with the comparative fit index (CFI), the Tucker-Lewis index (TLI), and the root mean squared error of approximation (RMSEA). Based on conventional rules of thumb (Hu & Bentler, 1999; Kline, 2011), acceptable and excellent model fit are indicated by CFI and TLI values >90 and .95, respectively, and by RMSEA values < .08 and .06, respectively. The TPB model, in which intention to use a reusable water bottle while at university was predicted by attitude, subjective norm, and perceived behavioral control (Fig. 1), showed excellent fit to the data (CFI .977, TLI .968, RMSEA .048). The model accounted for 52% of the variance in intention. Structural coefficients showed that intention was significantly associated with attitude ($\beta = .49$, $p < .001$), descriptive norm ($\beta = .10$, $p < .05$), and perceived behavioral control ($\beta = .22$, $p < .001$), whereas the influence of injunctive norm was not significant ($\beta = .06$, $p > .20$).

Figure 1

A TPB-based model of the intention to drink by reusable water bottles at University



Note. The figure depicts the structural equation model of the intention to drink by a refillable water bottle when at university. Point estimates for the two groups of students are shown on arrows (soft science students in parentheses). PBC = Perceived behavioral control.

* = p < .05; ** = p < .01; *** = p < .001

For an analysis of the association between these variables across the two groups of students involved in hard vs. soft sciences, we ran a multigroup structural equation model (M-SEM), with the dummy variable "course" representing the two groups of participants. The model showed an excellent fit to the data (CFI .959, TLI .964, RMSEA .055), accounting for 51% and 56% of the variance in intention of students majoring in the hard and the soft sciences, respectively. Inspection of structural coefficients (Table 3) revealed that the intention of hard science students to use a reusable water bottle while at university was significantly affected by attitude and perceived behavioral control, whereas injunctive and descriptive norms exerted no significant influence. The intention of soft science students was affected by attitude as well, albeit with a larger effect size. Intention was not associated with perceived behavioral control, whereas descriptive norm exerted a significative influence.

Table 3.

The effect of TPB factors on intention to use reusable bottles across students of hard vs. soft sciences.

	Variable	β	se	z	p	95% CI
Hard sciences	ATT	.31	.11	2.82	0.005	.095 .53
	SNi	.07	.08	0.87	0.385	-.09 .24
	SNd	.09	.06	1.45	0.147	-.03 .21
	PBC	.39	.09	4.19	0.000	.21 .58
Soft sciences	ATT	.63	.09	7.21	0.000	.46 .80
	SNi	.04	.07	0.49	0.621	-.11 .18
	SNd	.10	.05	1.97	0.049	.00 .20
	PBC	.11	.07	1.63	0.103	-.02 .25

Note. Dependent variable: Intention to use a reusable bottle at University. ATT = Attitude; SNi = Subjective norm – injunctive; SNd = Subjective norm – descriptive; PBC = Perceived behavioral control.

5. Discussion

Our findings show that the intention to use a reusable water bottle while at university may be explored in the framework of TPB. The structural equation model based on TPB explained a large proportion of variance in the entire sample and the two subsamples. Several differences between the students majoring in the hard sciences and those in the soft sciences were observed, though the two groups did not differ widely in average scores for attitude, subjective norm, and perceived behavioral control. The difference lay in the influence that attitude toward behavior, subjective norm, and perceived behavioral control had on their intention to drink tap water from a reusable bottle (for a discussion of group comparisons in relation to differences between mean and effect of variables, see Scafuto & La Barbera, 2016). Our data indicate that the humanities and social sciences group based their intention to a greater extent on attitude than the other group. In contrast, the hard science students based their intention also on perceived behavioral control. We may speculate that the soft science students placed more importance on the evaluation/interpretation of behavior, whereas for the hard science students control was also important.

Moreover, the university studies program may influence the relative strength of the TPB factors on intention to engage in a pro-environmental behavior through social identity, namely, the aspects of an individual's self-concept derived from being a member of one (or more) social groups (Tajfel & Turner, 1979). For example, as Jungert (2013) pointed out, science and engineering students construct a *science-driven* social identity, which might be more resistant to social pressure (Mareshet al., 2016). This could explain why the effect of descriptive social norm was significant only for the soft science students.

Previous studies have compared the differences between students on university courses with reference to the educational content (knowledge). Environmental knowledge refers to knowledge about environmental problems and possible solutions, which may also include awareness, and it is closely tied to pro-environmental attitudes (Bamberg, 2003; Steg & Vlek, 2009). Numerous studies on environmental issues have involved university students, but few have compared participants'

knowledge of environmental topics. Those that have, found few or no correlations between knowledge and pro-environmental behavior. For example, Connell and Kozar (2012) reported that after taking an ad hoc course, undergraduate students in textiles and apparel demonstrated greater knowledge about social and environmental issues related to the textile industry, but this added knowledge did not lead to substantial change in their apparel buying behavior. Arnon, Orion and Carmi (2015) found that environmental values and attitudes were more predictive than environmental knowledge in explaining variation in pro-environmental behaviors. Other studies (Awan & Abbasi, 2013; Sammalisto, Sundström, Von Haartman, Holm, & Yao, 2016; Ull, Martínez-Agut, Piñero, & Aznar-Minguet, 2014) underlined the need to combine the knowledge acquired through educational courses with awareness, action, and effectiveness in order to achieve change in pro-environment behavioral among students. Even when results indicate a clear connection between environmental education and action (Zsóka, Szerényi, Széchy, & Kocsis, 2013), student behavior is not fully coherent with attitudes.

Our findings may elucidate the relationship between environmental knowledge, environmental attitudes, and pro-environmental behavior in students on different university courses. As our study shows, an integrated view of attitudes, social norms, and perceived behavioral control – as the TPB requires – provides an explanation of intention to behave in a pro-environmental fashion and of the mechanisms underlying the differences between the hard science and the soft science students. Social identity-based models may also be a useful tool to better understand the behavior and awareness of environmental issues between the two groups.

The limitations of the present study are the convenience sample and the absence of a behavioral measure. Further studies are needed to test our TPB-based model in relation to other cultural contexts and different pro-environmental behaviors. Also, the reliability of our measure of perceived behavioral control is not adequate. This could have been due to the items tapping into two different dimensions of control, namely, autonomy (one's own perceived responsibility to behave in a certain way) and capacity (connected to the perceived difficulty of the behavior). As pointed out

by Fishbein and Ajzen (2010), the three major constructs of the theory may be studied by distinguishing two components: instrumental/experiential for attitude, injunctive/descriptive for subjective norm, autonomy/capacity for perceived behavioral control. In line with the bulk of TPB-based research, we used the subdimensions of subjective norm. Nevertheless, investigating pro-environmental topics with more comprehensive TPB models, which include subdimensions for all three main theoretical constructs, could be an avenue for future research.

6. Conclusion

From a theoretical perspective, our findings suggest that the theory of planned behavior could be a comprehensive and useful framework for gaining a better understanding of pro-environmental behavior. In this example of carrying water in a reusable bottle for drinking, our results show that the major constructs of TPB—attitude, subjective norm, and perceived behavioral control—were significantly associated with intention to use a reusable bottle containing tap water for drinking while at university. Also, the influence of attitude on intention was particularly strong for the soft science students, whereas perceived behavioral control was noted to influence the behavioral intentions of the hard science students. We speculate that hard science studies might contribute to a more "control-oriented" worldview, whereas the evaluation (interpretation) of behaviors—which determine attitudes—might be a more important feature of soft science curricula, and that this difference might in turn moderate the relative influence of the TPB factors on intention.

From a practical perspective, our findings suggest that interventions promoting the use of bottles refilled with tap water rather than buying bottled water should target the constructs of attitude and perceived behavioral control. This means that multiple strategies need to be implemented to improve the evaluation of one's behavior—carrying a reusable bottle—and the perceived/actual easiness to perform it, as well. Finally, our findings draw on recommendations for

taking social norms into account and how they are perceived by individuals, because this could also foster or hinder the intention to adopt pro-environmental behavior.

References

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckmann (Eds.), *Action-control: From cognition to behavior* (pp. 1l-39). Heidelberg: Springer.

Ajzen, I. (1988). Attitudes. *Personality and Behavior*. Dorsey Press, Chicago.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179-211.

Armitage, C. J., & Conner, M. (1999). Predictive validity of the theory of planned behaviour: The role of questionnaire format and social desirability. *Journal of Community & Applied Social Psychology*, *9*(4), 261-272.

Arnon, S., Orion, N., & Carmi, N. (2015). Environmental literacy components and their promotion by institutions of higher education: An Israeli case study. *Environmental Education Research, 21*(7), 1029-1055.

Awan, U., & Abbasi, A. S. (2013). Environmental sustainability through determinism: the level of environmental awareness, knowledge and behavior among business graduates. *Research Journal of Environmental and Earth Sciences*, *5*(9), 505-515.

Bamberg, S. (2003). How does environmental concern influence specific environmentally related behaviors? A new answer to an old question. *Journal of Environmental Psychology*, *23*(1), 21-32.

Bamberg, S., Ajzen, I., & Schmidt, P. (2003). Choice of travel mode in the theory of planned behavior: The roles of past behavior, habit, and reasoned action. *Basic and Applied Social Psychology*, *25*(3), 175-187.

Becher, T. (1994). The significance of disciplinary differences. *Studies in Higher Education, 19*(2), 151-161.

Benavides, P. T., Dunn, J. B., Han, J., Biddy, M., & Markham, J. (2018). Exploring Comparative Energy and Environmental Benefits of Virgin, Recycled, and Bio-Derived PET Bottles. *ACS Sustainable Chemistry & Engineering*, *6* (8), 9725-9733.

Beverage Marketing Corporation. *The Global Bottled Water Market*, 2018.

Biglan, A. (1973). The characteristics of subject matter in different scientific areas. *Journal of Applied Psychology*, *57*, 204-213.

Blanchard, C. M., Kupperman, J., Sparling, P., Nehl, E., Rhodes, R. E., Courneya, K. S., ... & Hunt, T. (2007). Ethnicity as a moderator of the theory of planned behavior and physical activity in college students. *Research Quarterly for Exercise and Sport*, *78*(5), 531-541.

Carrus, G., Passafaro, P., & Bonnes, M. (2008). Teoria del Comportamento Pianificato e norme locali: uno studio sulla raccolta differenziata dei rifiuti domestici. [Theory of Planned Behavior and local norms: A study on recycle of domestic waste]. *Rassegna di Psicologia*, *25*, 27-43.

Censis Foundation. (2018). *Il valore sociale del consumo di acque minerali. Sintesi dei principali risultati.* [The social value of mineral water consumption]. Retrieved from https://www.censis.it/economia/il-valore-sociale-del-consumo-di-acque-minerali-sintesi-dei-risultati

Chu, P. Y., & Chiu, J. F. (2003). Factors influencing household waste recycling behavior: test of an integrated model. *Journal of Applied Social Psychology*, *33*(3), 604-626.

Cialdini, R. B., Reno, R. R., & Kallgren, C. A. (1990). A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places. *Journal of Personality and Social Psychology*, *58*, 1015-1026.

Connell, K. Y., & Kozar, J.M. (2012). Sustainability Knowledge and Behaviors of Apparel and Textile Undergraduates. *International Journal of Sustainability in Higher Education, 13*(*4*), 394–407.

Conner, M., Povey, R., Sparks, P., James, R., & Shepherd, R. (2003). Moderating role of attitudinal ambivalence within the theory of planned behaviour. *British Journal of Social Psychology*, *42*(1), 75-94.

Cooper, B. (2017). What drives compliance? An application of the theory of planned behaviour to urban water restrictions using structural equation modelling. *Applied Economics, 49*(14), 1426-1439.

De Bruijn, G. J., Brug, J., & Van Lenthe, F. J. (2009). Neuroticism, conscientiousness and fruit consumption: Exploring mediator and moderator effects in the theory of planned behaviour. *Psychology and Health, 24*(9), 1051-1069.

De Leeuw, A., Valois, P., Ajzen, I., & Schmidt, P. (2015). Using the theory of planned behavior to identify key beliefs underlying pro-environmental behavior in high-school students: Implications for educational interventions. *Journal of Environmental Psychology, 42*, 128-138.

Dean, M., Raats, M. M., & Shepherd, R. (2012). The Role of Self-Identity, Past Behavior, and Their Interaction in Predicting Intention to Purchase Fresh and Processed Organic Food. *Journal of Applied Social Psychology*, *42*(3), 669-688.

Debbeler, L. J., Gamp, M., Blumenschein, M., Keim, D., & Renner, B. (2018). Polarized but illusory beliefs about tap and bottled water: A product-and consumer-oriented survey and blind tasting experiment. *Science of The Total Environment, 643*, 1400-1410.

Dell'Isola, M., Di Antonio, G., Ficco, G., Forni, A., & Russi, A. (2012). Risparmio energetico derivante dall'utilizzo di sistemi domestici per il trattamento delle acque di rete. [Energy savings from the use of domestic mains water treatment systems]. Presented at 67° Congresso Nazionale ATI – Trieste, September, 2012.

Díez, J. R., Antigüedad, I., Agirre, E., & Rico, A. (2018). Perceptions and consumption of bottled water at the University of the Basque Country: Showcasing tap water as the real alternative towards a water-sustainable university. *Sustainability*, *10*(10), 3431.

Doria, M. F. (2006). Bottled water versus tap water: Understanding consumers' preferences. *Journal of Water and Health, 4*, 271-276.

Doria, M. F. (2010). Factors influencing public perception of drinking water quality. *Water Policy, 12*, 1-19.

Espinosa-Garcìa, A. C., Díaz-Ávalos, C., González-Villarreal, F. J., Val-Segura, R., Malvaez-Orozco, V., & Mazari-Hiriart, M. (2015). Drinking water quality in a Mexico City University community: perception and preferences. *EcoHealth*, *12*(1), 88-97.

Etale, A., Jobin, M., & Siegrist, M. (2018). Tap versus bottled water consumption: The influence of social norms, affect and image on consumer choice. *Appetite*, *121*, 138-146.

European Commission. (2018). *A European Strategy for Plastics in a Circular Economy*. Retrieved from https://ec.europa.eu/environment/circular-economy/pdf/plastics-strategy.pdf.

Fishbein, M., & Ajzen, I. (2010). *Predicting and changing behavior: The reasoned action approach*. New York: Psychology Press.

Gleick, P. H. (2010). *Bottled and sold: The story behind our obsession with bottled water*. Oakland, CA: Pacific Institute.

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1-55.

Jungert, T. (2013). Social identities among engineering students and through their transition to work: a longitudinal study. *Studies in Higher Education*, *38*(1), 39-52.

Kang, J., Grable, K., Hustvedt, G., & Ahn, M. (2017). Sustainable water consumption: The perspective of Hispanic consumers. *Journal of Environmental Psychology, 50*, 94-103.

Kline, R. (2011). *Principles and Practice of Structural Equation Modeling*. New York: Guilford Press.

La Barbera, F., & Ajzen, I., (2020). Understanding Support for European Integration Across Generations: A Study Guided by the Theory of Planned Behavior, *Europe's Journal of Psychology*, 16(3), 437-457.

Labra, M., & Casiraghi, M. (2010). L'acqua del rubinetto è buona, ma non ci fidiamo. [The tap water is good, but we do not trust it]. *Consumatori, Diritti e Mercato*, *2*, 90-100.

Legambiente, & Altraeconomia. (2018). *Acque in bottiglia 2018. Un'anomalia tutta italiana. [Bottled waters 2018. An Italian anomaly]*. Retrieved from https://www.legambiente.it/sites/default/files/images/acque_in_bottiglia_2018.pdf.

Levêque, J. G., & Burns, R. C. (2018). Drinking water in West Virginia (USA): tap water or bottled water–what is the right choice for college students?. *Journal of Water and Health*, *16*(5), 827-838.

Maresch, D., Harms, R., Kailer, N., & Wimmer-Wurm, B. (2016). The impact of entrepreneurship education on the entrepreneurial intention of students in science and engineering versus business studies university programs. *Technological Forecasting and Social Change*, *104*, 172-179.

Mazzoni, D., & Cicognani, E. (2013). Water as a commons: An exploratory study on the motives for collective action among Italian water movement activists. *Journal of Community & Applied Social Psychology*, *23*(4), 314-330.

O'Donnell, C., & Rice, R. E. (2012). A communications approach to campus bottled water campaigns. *Social Marketing Quarterly*, *18*, 255-273.

Pacific Institute. (2007). *Bottled water and energy fact sheet*. Oakland, CA: The Pacific Institute. Retrieved from http://www.pacinst.org/publication/bottledwater-and-energy-a-fact-sheet/

Pierrette, M., Heitz, C., Barbier, R., & Daniel, F. J. (2018). Behavioral intention in household practices: Making one's own cleaning product to limit pollution. *Pratiques Psychologiques*, *24*(1), 65-78.

Qian, N. (2018). Bottled water or tap water? A comparative study of drinking water choices on university campuses. *Water*, *10*(1), 59.

Robledo, J. L. R., Arán, M. V., Sanchez, V. M., & Molina, M. Á. R. (2015). The moderating role of gender on entrepreneurial intentions: A TPB perspective. *Intangible Capital*, *11*(1), 92-117.

Royte, E. (2008). *Bottlemania: How water went on sale and why we bought it*. New York: Bloomsbury.

Ru, X., Wang, S., & Yan, S. (2018). Exploring the effects of normative factors and perceived behavioral control on individual's energy-saving intention: An empirical study in eastern China. *Resources, Conservation and Recycling*, *134*, 91-99.

Sammalisto, K., Sundström, A., Von Haartman, R., Holm, T., & Yao, Z. (2016). Learning about sustainability—What influences students' self-perceived sustainability actions after undergraduate education?. *Sustainability*, *8*(6), 510.

Saylor, A., Prokopy, L. S., & Amberg, S. (2011). What's wrong with the tap? Examining perceptions of tap water and bottled water at Purdue University. *Environmental Management*, *48*(3), 588-601.

Scafuto, F., & La Barbera, F. (2016). Protest Against Waste Contamination in the 'Land of Fires': Psychological Antecedents for Activists and Non-activists. *Journal of Community & Applied Social Psychology*, *26*(6), 481-495.

Shiva, V. (2002). *Water Wars. Privatisation, Pollution and Profit*. Cambridge, Mass.: South End Press.

Sparks, P., & Shepherd, R. (1992). Self-identity and the theory of planned behavior: Assessing the role of identification with" green consumerism". *Social Psychology Quarterly*, *55*(4) 388-399.

Srivastava, C., & Mahendar, G. (2018). Intention to Adopt Sustainable Energy: Applying the Theory of Planned Behaviour Framework. *Indian Journal of Marketing*, *49*(10), 20-33.

Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, *29*(3), 309-317.

Tajfel, H., & Turner, J. C. (1979). An integrative theory of intergroup conflict. M.J. Hatch & M. Shultz (Eds.), *Organizational identity. A reader* (pp. 56-65). Oxford: Oxford University Press.

Terry, D. J., Hogg, M. A., & White, K. M. (1999). The theory of planned behaviour: self-identity, social identity and group norms. *British Journal of Social Psychology*, *38*(3), 225-244.

Uehara, T., & Ynacay-Nye, A. (2018). How water bottle refill stations contribute to campus sustainability: A case study in Japan. *Sustainability*, *10*(9), 3074.

Ull, M. A., Martínez-Agut, M. P., Piñero, A., & Aznar-Minguet, P. (2014). Perceptions and attitudes of students of teacher-training towards environment and sustainability. *Procedia – Social and Behavioral Science*, *131*, 453-457.

Vabø, M. and Hansen, H. (2016). Purchase intentions for domestic food: a moderated TPB-explanation. *British Food Journal*, *118*(10), 2372-2387.

Van Der Linden, S. (2015). Exploring beliefs about bottled water and intentions to reduce consumption: The dual-effect of social norm activation and persuasive information. *Environment and Behavior*, *47*(5), 526-550.

Wang, S., Fan, J., Zhao, D., Yang, S., & Fu, Y. (2016). Predicting consumers' intention to adopt hybrid electric vehicles: using an extended version of the theory of planned behavior model. *Transportation*, *43*(1), 123-143.

Ward, L. A., Cain, O. L., Mullally, R. A., Holliday, K. S., Wernham, A. G., Baillie, P. D., & Greenfield, S. M. (2009). Health beliefs about bottled water: a qualitative study. *BMC Public Health*, *9*(1), 196.

Xu, X., & Lin, C. A. (2018). Effects of Cognitive, Affective, and Behavioral Factors on College Students' Bottled Water Purchase Intentions. *Communication Research Reports*, *35*(3), 245-255.

Zsóka, Á., Szerényi, Z. M., Széchy, A., & Kocsis, T. (2013). Greening due to environmental education? Environmental knowledge, attitudes, consumer behavior and everyday pro-environmental activities of Hungarian high school and university students. *Journal of Cleaner Production*, *48*, 126-138.

Angela Fedi, PhD, is associate professor in social and community psychology at University of Turin, Department of Psychology. Her main research interests refer to sustainability, social change, participation and group dynamics.

Francesco La Barbera, PhD, is associate professor in social psychology at the Federico II University of Naples. He is working on subjects related to the theory of planned behavior, consumer behavior, and environmental sustainability.

Annabelle de Jong graduated in clinical psychology at the University of Turin. During her study, she became interested in environmental psychology and changing habits in promoting sustainability. She deals with environmental education.

Chiara Rollero, PhD, is associate professor in social psychology at the University of Turin. Her research focuses on gender issues, well-being, and human environment interactions.